

What is claimed is:

1. A method of creating closely spaced contact holes, comprising the steps of:

(1) providing a substrate, said substrate having been provided with a first layer of material for creation of a pattern of contact holes;

(2) exposing the surface of said first layer of material with a first mask, said first mask comprising a first and a second pattern of contact holes;

(3) creating openings in said first layer of material in accordance with said first and second pattern of contact holes;

(4) depositing a second layer of material over the surface of said first layer of material, including said openings created in said first layer of material in accordance with said first and second pattern of holes;

(5) exposing the surface of said second layer of material with a mask selected from the group consisting of:

(i) a second mask comprising a third pattern of holes, said third pattern of holes being aligned with said second pattern of holes, said third pattern of holes being a transparent pattern of holes with a surrounding opaque background surface

(ii) a third mask comprising a third pattern of holes, said third pattern of holes being aligned with said second pattern of

holes, said third pattern of holes being an opaque pattern of holes with a surrounding transparent background surface

(iii) a fourth mask comprising a fourth pattern of holes, said fourth pattern of holes being aligned with said first pattern of holes, said fourth pattern of holes being a transparent pattern of holes with a surrounding opaque background surface;

(iv) a fifth mask comprising a fourth pattern of holes, said fourth pattern of holes being aligned with said first pattern of holes, said fourth pattern of holes being an opaque pattern of holes with a surrounding transparent background surface; and

(6) creating openings in said second layer of material in accordance with said third or fourth pattern of holes, holes of said third or fourth pattern of holes having a diameter being larger than a diameter of holes of said first and second pattern of holes by a measurable amount.

2. The method of claim 1, said first pattern of holes comprising contact holes.

3. The method of claim 1, said second pattern of holes comprising dummy holes.

4. The method of claim 1, wherein said creating openings in said second layer of material in accordance with said third or fourth pattern of holes comprises the steps of:

selecting a negative photoresist for said second layer of material;

providing said second mask;

aligning said third pattern of holes provided in said second mask with said second pattern of holes created in said first layer of material;

exposing the surface of said second layer of material in accordance with said third pattern of holes provided in said second mask; and

developing said second layer of material in accordance with said third pattern of holes provided in said second mask.

5. The method of claim 1, wherein said creating openings in said second layer of material in accordance with said third or fourth pattern of holes comprises the steps of:

selecting a positive photoresist for said second layer of material;

providing said third mask;

aligning said third pattern of holes provided in said third mask with said second pattern of holes created in said first layer of material;

exposing the surface of said second layer of material in accordance with said third pattern of holes provided in said second mask; and

developing said second layer of material in accordance with said third pattern of holes provided in said second mask.

6. The method of claim 1, wherein said creating openings in said second layer of material in accordance with said third or fourth pattern of holes comprises the steps of:

selecting a positive photoresist for said second layer of material;

providing said fourth mask;

aligning said fourth pattern of holes provided in said fourth mask with said second pattern of holes created in said first layer of material;

exposing the surface of said second layer of material in accordance with said fourth pattern of holes provided in said fourth mask; and

developing said second layer of material in accordance with said fourth pattern of holes provided in said fourth mask.

7. The method of claim 1, wherein said creating openings in said second layer of material in accordance with said third or fourth pattern of holes comprises the steps of:

selecting a negative photoresist for said second layer of material;

providing said fifth mask;

aligning said fourth pattern of holes provided in said fifth mask with said second pattern of holes created in said first layer of material;

exposing the surface of said second layer of material in accordance with said fourth pattern of holes provided in said fifth mask; and

developing said second layer of material in accordance with said fourth pattern of holes provided in said fifth mask.

8. The method of claim 1 wherein said first layer of material comprises photoresist.

9. The method of claim 1, said second layer of material comprising photoresist.

10. The method of claim 1, said first layer of material comprising an insulating material.

11. The method of claim 1, said second layer of material comprising a photo sensitive insulating material.

12. The method of claim 1, with an additional step of cross-linking said first layer of material.

13. The method of claim 1, with an additional step of hardening the surface of said first layer of material.

14. The method of claim 1, said holes of said second pattern being created by adding one additional hole to each side of holes of said first pattern.

15. The method of claim 14, said one additional hole being separated from said each side of holes of said first pattern by an equal distance.

16. The method of claim 15, said equal distance being within a range of between one time and two times the size of a largest cross section of said first hole.

17. The method of claim 14, said one additional hole having a cross section of a size about equal to a cross section of holes of said first pattern.

18. The method of claim 1 wherein overlapping holes of said second pattern of holes are combined into larger holes.

19. The method of claim 14, said one additional hole added to each side of holes of said first pattern being eliminated where said one additional hole overlaps holes of said first pattern of holes.

20. A method of creating closely spaced contact holes, comprising the steps of:

providing a substrate, said substrate having been provided with a layer of dual-polarity resist for creation of a pattern of contact holes;

exposing the surface of said layer of dual-polarity resist with a mask, said mask comprising a first and a second pattern of contact holes, creating a first and a second pattern of exposure in said layer of dual-polarity resist;

selectively exposing the surface of said layer of dual-polarity resist to a source of radiation, said selective exposure being in accordance with said second pattern of exposure in said layer of dual-polarity resist, thereby inhibiting creating openings in said layer of dual-polarity resist in accordance with said second pattern of exposure; and

developing said layer of dual-polarity resist in accordance with said first pattern of exposure.

21. The method of claim 20, said first pattern of exposure comprising contact holes.

22. The method of claim 20, said second pattern of exposure comprising dummy holes.

23. A method of creating closely spaced contact holes, comprising the steps of:

providing a substrate, said substrate having been provided with a layer of dual-polarity resist for creation of a pattern of contact holes;

exposing the surface of said layer of photoresist with a mask, said mask comprising a first and a second pattern of contact holes, creating a first and a second pattern of exposure in said layer of dual-polarity resist;

selectively exposing the surface of said layer of photoresist to a source of radiation, said selective exposure being in accordance with said second pattern of exposure in said layer of dual-polarity resist, thereby hardening the surface of said layer of photoresist, inhibiting creating openings in said layer of photoresist in accordance with said second pattern of exposure; and

developing said layer of photoresist in accordance with said first pattern of exposure.

24. The method of claim 23, said first pattern of holes comprising contact holes.

25. The method of claim 23, said second pattern of holes comprising dummy holes.

26. A packed mask for creating closely spaced contact holes, comprising:

    a first mask comprising a first and a second pattern of contact holes;

    a second mask comprising a third pattern of holes, said third pattern of holes being aligned with said second pattern of holes, said third pattern of holes being a transparent pattern of holes with a surrounding opaque background surface.

27. The packed mask of claim 26, said first pattern of holes comprising contact holes.

28. The packed mask of claim 26, said second pattern of holes comprising dummy holes.

29. The packed mask of claim 26, said holes of said second pattern being created by adding one additional hole to each side of holes of said first pattern.

30. The packed mask of claim 29, said one additional hole being separated from said each side of holes of said first pattern by an equal distance.

31. The packed mask of claim 30, said equal distance being within a range of between one time and two time the size of a largest cross section of said first hole.

32. The packed mask of claim 30, said one additional hole having a cross section of a size about equal to a cross section of holes of said first pattern.

33. The packed mask of claim 26, overlapping holes of said second pattern of holes being combined into larger holes.

34. The packed mask of claim 26, said one additional hole added to each side of holes of said first pattern being eliminated where said one additional hole overlaps holes of said first pattern of holes.

35. A packed mask for creating closely spaced contact holes, comprising:

a first mask comprising a first and a second pattern of contact holes;

a third mask comprising a third pattern of holes, said third pattern of holes being aligned with said first pattern of holes, said third pattern of holes being an opaque pattern of holes with a surrounding transparent background surface.

36. The packed mask of claim 35, said first pattern of holes comprising contact holes.

37. The packed mask of claim 35, said second pattern of holes comprising dummy holes.

38. The packed mask of claim 35, said holes of said second pattern being created by adding one additional hole to each side of holes of said first pattern.

39. The packed mask of claim 37, said one additional hole being separated from said each side of holes of said first pattern by an equal distance.

40. The packed mask of claim 39, said equal distance being within a range of between one time and two time the size of a largest cross section of said first hole.

41. The packed mask of claim 38, said one additional hole having a cross section of a size about equal to a cross section of holes of said first pattern.

42. The packed mask of claim 35, overlapping holes of said second pattern of holes being combined into larger holes.

43. The packed mask of claim 38, said one additional hole added to each side of holes of said first pattern being eliminated where said one additional hole overlaps holes of said first pattern of holes.

44. A packed mask for creating closely spaced contact holes, comprising:

a first mask comprising a first and a second pattern of contact holes;

a fourth mask comprising a fourth pattern of holes, said fourth pattern of holes being aligned with said second pattern of holes, said fourth pattern of holes being transparent pattern of holes with a surrounding opaque background surface.

45. The packed mask of claim 44, said first pattern of holes comprising dummy holes.

46. The packed mask of claim 44, said second pattern of holes comprising contact holes.

47. The packed mask of claim 44, said holes of said second pattern being created by adding one additional hole to each side of holes of said first pattern.

48. The packed mask of claim 47, said one additional hole being separated from said each side of holes of said first pattern by an equal distance.

49. The packed mask of claim 48, said equal distance being within a range of between one time and two time the size of a largest cross section of said first hole.

50. The packed mask of claim 47, said one additional hole having a cross section of a size about equal to a cross section of holes of said first pattern.

51. The packed mask of claim 44, overlapping holes of said second pattern of holes being combined into larger holes.

52. The packed mask of claim 47, said one additional hole added to each side of holes of said first pattern being eliminated

where said one additional hole overlaps holes of said first pattern of holes.

53. A packed mask for creating closely spaced contact holes, comprising:

a first mask comprising a first and a second pattern of contact holes;

a fifth mask comprising a fourth pattern of holes, said fourth pattern of holes being aligned with said second pattern of holes, said fourth pattern of holes being an opaque pattern of holes with a surrounding transparent background surface.

54. The packed mask of claim 53, said first pattern of holes comprising dummy holes.

55. The packed mask of claim 53, said second pattern of holes comprising contact holes.

56. The packed mask of claim 54, said holes of said second pattern being created by adding one additional hole to each side of holes of said first pattern.

57. The packed mask of claim 56, said one additional hole being separated from said each side of holes of said first pattern by an equal distance.

58. The packed mask of claim 57, said equal distance being within a range of between one time and two time the size of a largest cross section of said first hole.

59. The packed mask of claim 56, said one additional hole having a cross section of a size about equal to a cross section of holes of said first pattern.

60. The packed mask of claim 53, overlapping holes of said second pattern of holes being combined into larger holes.

61. The packed mask of claim 56, said one additional hole added to each side of holes of said first pattern being eliminated where said one additional hole overlaps holes of said first pattern of holes.